GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the CENTRAL REGION of Ontario, 1987

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

W. D. Biggs, R. J. Sajan and H. Brodersen

Miscellaneous Report No. 75

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The Great Lakes Forestry Centre is one of six regional establishments located across Canada and operated by the Canadian Forestry Service. The overall objective of the Service is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. The Centre pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

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92-05259/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE CENTRAL REGION OF ONTARIO 1987

(FOREST DISTRICTS: HURONIA, LINDSAY, CAMBRIDGE, MAPLE AND NIAGARA)

W.D. BIGGS, R.J. SAJAN AND H. BRODERSEN

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

1988

MISCELLANEOUS REPORT NO. 75

©Minister of Supply and Services Canada 1988
Catalogue No. Fo 29-8/75E
ISBN 0-662-16199-8
ISSN 0832-7130

Copies of this publication are available at no charge from:

Communications Services
Great Lakes Forestry Centre
Canadian Forestry Service
Government of Canada
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Microfiches of this publication may be purchased from:

Micromedia Inc.
Place du Portage
165, Hôtel-de-Ville
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J8X 3X2

SURVEY HIGHLIGHTS

This report summarizes data gathered on various insects, diseases, and abiotic damage during surveys carried out in the Central Region of Ontario in 1987. Forest tent caterpillar and oak leaf shredder populations increased in Huronia District; in contrast, Bruce spanworm populations collapsed. The gypsy moth continued to spread westward and the area damaged in Lindsay District increased. The pine false webworm was more prevalent in Huronia District; birch leafminer damage became more prevalent across the region.

Damage caused by tip blight continued to be most noticeable in Maple and Cambridge districts and was also observed at damaging levels in Huronia District. Septoria leaf spot damage was much lower this year in comparison with the extremely high infection levels of 1986. Maple dieback monitoring plots were established and the long-standing oak decline plots were retallied in 1987.

Hardwoods damaged by drought were found at scattered locations across the northern boundary of the region. Other abiotic damage occurred at lower levels than in the previous year.

White spruce plantations and cones were examined as part of special surveys. Some additional work was done on the pinewood nematode. A check of the ARNEWS (Acid Rain National Early Warning System) plots revealed no sign of pollution-related damage.

Insects and diseases described in this report fall into three categories, on the basis of their importance:

Major Insects or Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects or Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects and Diseases (Tables)

These tables provide information on two types of pest:

(1) those which are of minor importance and have not been known to cause serious damage to forest trees,

(2) those which are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage this year.

The cooperation and assistance provided by the Ontario Ministry of Natural Resources (OMNR), Agriculture Canada and other government agencies and individuals are gratefully acknowledged.

If further information is required about pest conditions in the Central Region, please contact W.D. Biggs or write to the Head, Forest Insect and Disease Survey Unit, Great Lakes Forestry Centre, P.O. Box 490, Sault Ste. Marie, Ontario, P6A 5M7.

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Frontispiece

Heavy damage to a Scots pine (*Pinus sylvestris* L.) Christmas tree caused by pine false webworm (*Acantholyda erythrocephala* [L.])

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Population levels of this pine insect increased in parts of the Central Region. Once again, large numbers of larvae were observed on 3.5-m red pine (*Pinus resinosa* Ait.) in a 20-ha plantation in Harvey Township, Lindsay District; this resulted in 90% defoliation of 100% of the trees examined. As a result of this heavy defoliation, 2% of the trees died. This insect is primarily a feeder on old foliage of various pine hosts, but when populations are very large, new foliage is sometimes consumed. This was the case on some of the 1.5-m Scots pine (*P. sylvestris* L.) in a 5-ha Christmas tree plantation in Essa Township in Huronia District (see Frontispiece), where 80-90% defoliation levels were observed on 60% of the trees, with lower damage levels on many others. As a result of pruning, these trees tended to be much thicker and had numerous branches, and consequently were perfect hosts for this insect. Approximately 30% of 2-m red pine were 20% defoliated in a 5-ha area in Flos Township, Huronia District. Similar numbers of affected trees were found in a 2-ha red pine plantation in Belmont Township, Lindsay District; however, defoliation levels were only 1%. Defoliation levels of about 5% were observed on 10% of the 2-m trees in a 3-ha red pine plantation at Canadian Forces Base (CFB) Borden, Huronia District. Sporadic, heavy damage was present on newly planted red pine over a 25-ha area in Whitchurch Township, Maple District. Various population levels were recorded at numerous other points in the region.

Shorthorned Oakworm, *Anisota finlaysoni* Riotte

Population levels increased in one area of Cambridge District. Approximately one dozen mature bur oak (*Quercus macrocarpa* Michx.), scattered over a large area of agricultural land, were 80-100% defoliated in Trafalgar Township northeast of Milton. Crowns or single branches of numerous other trees in this area experienced light defoliation by this insect. In contrast, reduced damage levels were observed in Onondaga Township, with only very light defoliation on a few branches of four roadside bur oak.

Cedar Leafminers, *Argyresthia aureoargentella* Brower, *A. canadensis* Free., *A. thuiella* (Pack.) and *Coleotechnites thujaella* (Kft.)

There was little change in the status of this group of insects that feed on eastern white cedar (*Thuja occidentalis* L.). Population levels appeared to increase across the northern edge of Lindsay District. Large populations were also detected on roadside trees along

Durham Regional Roads 19 and 57 in the Purple Hill-Blackstock area of Lindsay District, and these caused about 75% foliar damage. Population levels remained stable in much of the remainder of the region, with low damage levels (5-25%) in many stands and hedgerows; this was particularly true in Niagara District, where eastern white cedar is not very abundant. Moderate populations, which caused a more noticeable browning of the foliage (30-40%), were observed less frequently this year. This was the case in the area south of Barrie and in Rama Township, Huronia District; in the Victory Tract of Wellington County Forest, Cambridge District; in many of the other townships of Lindsay District; and south of Lake Simcoe, Maple District. The trees recovered well from attack by these leafminers and by mid-summer appeared to be green and healthy.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Endemic populations of the budworm were present in the Central Region. Larvae were present on white spruce (*Picea glauca* [Moench] Voss) in Uxbridge Township, Maple District, and in the Orono Tree Seed Orchard, Lindsay District, but populations were not large enough to cause noticeable defoliation.

At the present time in Ontario, the last stronghold of the spruce budworm is in the Northwestern and North Central regions. Population levels were lower this year, and consequently the area infested and the intensity of defoliation were reduced. All together, 7,189,763 ha of moderate-to-severe defoliation were mapped, a reduction of 1,665,924 ha since 1986. In all, 82,174 ha of spruce budworm-caused balsam fir (*Abies balsamea* [L.] Mill.) mortality were mapped in 1987 at scattered points in the Northwestern and North Central regions. The cumulative total of budworm-killed timber is now 14,067,082 ha. In other regions of the province, mortality resulted from major infestations that date back to the early 1970s.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Population levels remained much the same as in previous years; only a few isolated areas had noteworthy damage. Approximately 1 ha of 14-m European larch (*Larix decidua* Mill.) had 70% foliar damage in the Cookstown Tract and 3 ha of similar-sized trees had average damage levels of 50% in the Hodson Tract, both in West Gwillimbury Township, Huronia District. Sufficient larch casebearers were present to cause a beige discoloration of foliage on scattered 12-m European larch in a 5-ha area in the Derrynane Tract on Grand River Conservation Authority property in Cambridge District. Similar populations were found that caused less than 10% foliar damage in a 0.5-ha pocket of Japanese larch (*L. leptolepis* [Sieb. & Zuca.] Gord.) in the Sandy Hill Tract of the Waterloo Regional Forest, Cambridge District.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

After three years of low population levels, there were noticeable increases in the number of leaf shredders in parts of both Huronia and Maple districts. A large (approximately 560 ha) pocket of damaged red oak (*Quercus rubra* L.) was present in Tiny Township, Huronia District. Most defoliation levels were in the 30-50% range, although occasional trees sustained heavier (70-80%) damage. Scattered trees had defoliation levels of 40-60% in the south end of the Main Tract of Durham Regional Forest in Uxbridge Township, Maple District, and at a few points in Awenda Provincial Park, Huronia District. Small populations were present at several other points in Huronia District, but defoliation levels never exceeded 10%. Trace levels of damage (1-5%) were common in all stands examined in Niagara and Lindsay districts.

Egg sampling was carried out at 21 locations (Table 1) as part of a continuing study of insect populations. Noteworthy increases in egg numbers were recorded at three locations, two in Awenda Provincial Park, Huronia District, and one at plot 2 in Uxbridge Township, Maple District. Moderate levels of defoliation are forecast for these locations in 1988. As part of this study, male moths were captured in pheromone traps on the same sites (Table 2).

Birch Leafminer, *Fenusa pusilla* (Lep.)

A marked increase in population levels of this insect occurred in 1987. This leafminer has long been known as a pest of open-grown ornamental white birch (*Betula papyrifera* Marsh.), most commonly in urban settings. Indeed, this was the case in 1987 in many urban centers across the Central Region. Furthermore, there were noticeable populations on many white birch in forest stands and woodlots. Brown leaves were observed on scattered trees, and there was 50-80% foliar damage in Esquesing Township, near Acton in Cambridge District, in King and Whitchurch townships, in Maple District, and in the areas around Orillia and between Alliston and Angus, in Huronia District. Population levels were commonly lower than in 1986 at many other points in the region.

Fall Webworm, *Hyphantria cunea* (Dru.)

Population levels decreased in the northern half of the region, whereas minimal increases were observed in Niagara District. The highest population levels were observed primarily on ornamental black walnut (*Juglans nigra* L.) along the Niagara Parkway, where webs totaled 30 to 50 per kilometre. Once again, insect colonies were found in relatively high numbers on ash (*Fraxinus* spp.) and elm (*Ulmus* spp.) along Ingram Road in Medonte Township, Huronia District, as well as at other scattered locations in the same township. Single webmasses on roadside elms were found at scattered locations in Lindsay District; this

represented a decrease from 1986 levels, particularly in the Kawartha Lakes area. Small populations were present on a variety of hardwood hosts throughout much of the remainder of the region.

Table 1. Summary of oak leaf shredder egg counts and defoliation forecasts for three districts in 1987.

Location		Mean no. of eggs per 38-cm sample 1986	1987	Defoliation forecast for 1988[a]
Huronia District				
Awenda Provincial Park	4	1.1	8.9	M
	5	0.0	0.0	N
	11	0.0	9.3	M
Dufferin County Forest	3	0.0	0.0	N
	9	0.1	0.0	N
	10	0.2	0.1	L
	12	0.0	0.0	N
	95	0.1	0.1	L
Check	3	0.2	0.6	L
Hendrie	1	0.2	0.5	L
Midhurst	1	0.0	0.5	L
Orr Lake - Daniels		0.0	0.0	N
Wildman Tract	4	0.2	1.0	L
	7	0.1	0.3	L
Maple District				
Uxbridge Twp	1	8.9	11.6	M
	2	6.0	19.0	M
Niagara District				
Cayuga Twp	1	0.1	0.4	L
Town of Thorold	6	0.5	4.8	L
Town of Pelham	5	0.1	2.6	L
	7	0.8	0.3	L
West Lincoln Twp	2	0.5	0.4	L

[a] N = nil, L = low, M = moderate

Table 2. Results of oak leaf shredder pheromone trapping in three districts in 1987.

Location		Total moths captured 1986	Total moths captured 1987	Avg no. per trap 1987	1987 defoliation (%)
Huronia District					
Awenda Provincial Park	4	239	782	156	67
	5	12	6	1	2
	11	123	82	16	42
Dufferin County Forest	3	8	0	0	4
	9	20	1	0.2	8
	10	142	196	39	8
	12	8	2	0.4	2
	95	15	84	17	4
[Check]	3	65	147	29	5
Hendrie	1	9	2	0.4	11
Midhurst	1	6	12	2	3
Orr Lake-Daniels		33	144	29	3
Wildman Tract	4	50	10	2	20
	7	36	341	68	12
Maple District					
Uxbridge Twp	1	712	763	153	54
	2	1,112	886	177	48
Niagara District					
Cayuga Twp	1	1	4	0.8	1
Town of Thorold	6	56	98	20	1
Town of Pelham	5	125	522	104	1
	7	0	453	91	1
West Lincoln Twp	2	28	189	38	1

Gypsy Moth, *Lymantria dispar* (L.)

This introduced insect continued to cause damage in Lindsay District and greater incidence was noted farther west in Maple and Huronia districts. Aerial surveys detected 888 ha of heavy defoliation (75-100%), mainly of red oak, in three separate townships in Lindsay District (Fig. 1). The largest area of damage was in Haldimand Township; it consisted of one large pocket (635 ha) along the eastern side of the township line and smaller pockets that totalled 107 ha north and west of the aforementioned area. Pockets of heavy defoliation large enough to map were found for the first time at four sites at the

HURONIA, MAPLE and LINDSAY DISTRICTS

Figure 1. Gypsy Moth, *lymantria dispar* (L.)

Areas within which moderate-to-severe defoliation occurred in 1987 . . . . . ●

Forest Insect and Disease Survey
Great Lakes Forestry Centre

northern end of Hope Township. These pockets, which totalled 118 ha, consisted mainly of red and bur oak with an understory of eastern white pine (*Pinus strobus* L.). The final area damaged consisted of a 28-ha pocket of heavily defoliated red oak in Belmont Township; this is a decrease from the 188 ha damaged in 1986. Larvae were observed at numerous other locations throughout Lindsay District; however, as a result of low population levels, defoliation was not observed.

In addition to larval trapping carried out in provincial parks (Table 3), larvae were found at trace levels in the Main Tract of the Durham Regional Forest, and a few caterpillars were reported by OMNR in the Newmarket area of Maple District. Larvae were found for the first time at Bass Lake, Springwater and Awenda provincial parks in Huronia District (Table 3). A single caterpillar was found near the Wildman Tract in Tiny Township, Huronia District.

Pheromone traps were deployed at provincial parks across the region as well as at CFB Borden. For the most part, the numbers of captured moths were much the same as in the previous year (Table 3). Male moths are found throughout the region but female moths, because they cannot fly, have reduced spread potential.

Gypsy moth egg surveys were carried out by OMNR during the late fall and early winter. The most significant numbers of egg masses were found at locations sampled in the Northumberland and Ganaraska forests, Lindsay District. Moderate-to-severe defoliation is expected to occur in 1988 at seven of the ten sampling points in the Northumberland County Forest, Haldimand Township, and at nine of the ten sites in the eastern half of the Ganaraska Forest, Hope Township. Light defoliation was predicted for the balance of the sample points in both areas. In addition to the high level of egg sampling in these two locations, sampling was carried out in the northern portion of Lindsay District. Severe defoliation is expected to recur in the Long Lake area of Belmont Township, and light defoliation is forecast at two sites in the Cordova Lake area of the same township. Light defoliation is also forecast for Balsam Lake Provincial Park and Indian Point in Bexley Township, Lindsay District. Of 86 woodlots examined in Niagara District, 33% contained egg masses; the majority of these sites had densities that indicated very small numbers. Large numbers of egg masses were found at seven locations in Pelham and Thorold townships. The potential for discernible defoliation exists at several of these locations. Egg detection surveys were also carried out in Maple and Huronia districts. Sufficient numbers of eggs were found in the southwest corner of the Main Tract of the Durham Regional Forest that light defoliation is predicted in 1988. In all, 13 locations were surveyed in Huronia District. One egg was found at each of four sites in Tiny, Vespra and Mulmur townships. Defoliation is not expected, but these areas should be monitored more closely in the future.

Table 3. Summary of gypsy moth pheromone and burlap trapping in 1987.

Location (Park)	No. of larvae caught in 10 burlap traps		Pheromone traps		
			No. of traps	No. of moths caught	
	1986	1987		1986	1987
Cambridge District					
Bronte Creek	3	16	2	29	42
Huronia District					
Awenda	0	15	2	58	46
Bass Lake	0	1	2	34	32
Devil's Glen	0	0	2	21	27
Earl Rowe	0	0	2	15	28
Mara	0	0	2	24	47
McRae Point	4	60	2	21	37
Six Mile Lake	0	0	2	29	16
Springwater	0	1	2	33	38
Wasaga Beach	0	0	2	0[b]	39
CFB Borden[a]	-	-	10	-	188
Lindsay District					
Balsam Lake	0	0	2	26	27
Darlington	24	11	2	46	35
Emily	2	15	1	36	1
Mark S. Burnham	0	0	2	41	58
Serpent Mounds	6	79	2	43	34
Maple District					
Sibbald	0	0	2	26	34

[a] not a provincial park; new pheromone site for 1987

[b] traps removed, no results

Eastern Tent Caterpillar, *Malacosoma americanum* F.

Very high population levels were found again at many locations in Huronia, Maple and Lindsay districts. Most roadside cherry (*Prunus* spp.) saplings were stripped, and some larger trees were also damaged in many areas of the Huronia District and north of a line along Hwy 9 in Maple District and into Lindsay District. Red and bur oak were also defoliated in northern Lindsay and Huronia districts along the edge of the

Canadian Shield. The caterpillar was common in other portions of Maple and Lindsay districts as well as in Cambridge and Niagara districts.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The area of moderate-to-severe defoliation increased in parts of Huronia and Lindsay districts and now totals 12,921 na. Most of these areas were a result of spill-over from larger infestations to the north, in Parry Sound, Bracebridge and Minden districts of the Algonquin Region. The primary hosts in most cases were trembling aspen (*Populus tremuloides* Michx.), red oak and sugar maple (*Acer saccharum* Marsh.), in that order. The largest single area damaged was 7,133 ha in Baxter and Matchedash townships, Huronia District (Fig. 2), where defoliation levels of 50-100% were common (see photo page). A sugar maple woodlot in Tiny Township, and scattered pockets of aspen in Rama and Mara townships, were damaged similarly in Huronia District. A total of 5,198 ha of moderate-to-severe defoliation was mapped in three separate areas along the north edge of Lindsay District (Fig. 2) in the townships of Bexley, Harvey, Smith and Belmont. Two small pockets of moderate (20-40%) damage were found in the Copeland Forest area in Medonte Township, Huronia District. Larvae were reported at many other points in Huronia and Lindsay districts, but not at damaging levels.

The heavy infestations that were present in the northern portions of Huronia and Lindsay districts are expected to persist in 1988 (Fig. 3). As a result of egg-band counts (see photo page) done in Harvey and Belmont townships in Lindsay District, severe defoliation is predicted for next year. The picture for Huronia District is a little more varied (Table 4). The heavy infestation that was present in the northern portion of the district is expected to persist in 1988. Severe defoliation was predicted for Six Mile Lake Provincial Park and near Severn Falls. Sufficient eggs were found that moderate levels are forecast on the east side of Tay Township, and small populations are expected at Awenda Provincial Park. Severe damage will again be evident in the sugar maple stand in the southeast corner of Tiny Township and in one section of the Copeland Forest. Along the eastern side of Huronia District severe pockets of damage are forecast in Rama and Mara townships.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Population levels remained much the same as they had been in 1986. Large numbers of larvae recurred on scattered 2- and 3-m windbreak red pine in Flos Township, Huronia District; about 20 trees were 100% defoliated, and many of these will probably die. Others had damage levels of 40-80%. Larvae show a preference for needles of the previous year's growth. Average defoliation levels of 20% were observed on four 0.4-m red pine at an experimental planting site in Vespra Township,

HURONIA, MAPLE and LINDSAY DISTRICTS

Figure 2. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas within which defoliation occurred in 1987

Moderate . . . . . ■

Moderate-to-heavy . . . . . ▩ or ●

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HURONIA, MAPLE and LINDSAY DISTRICTS

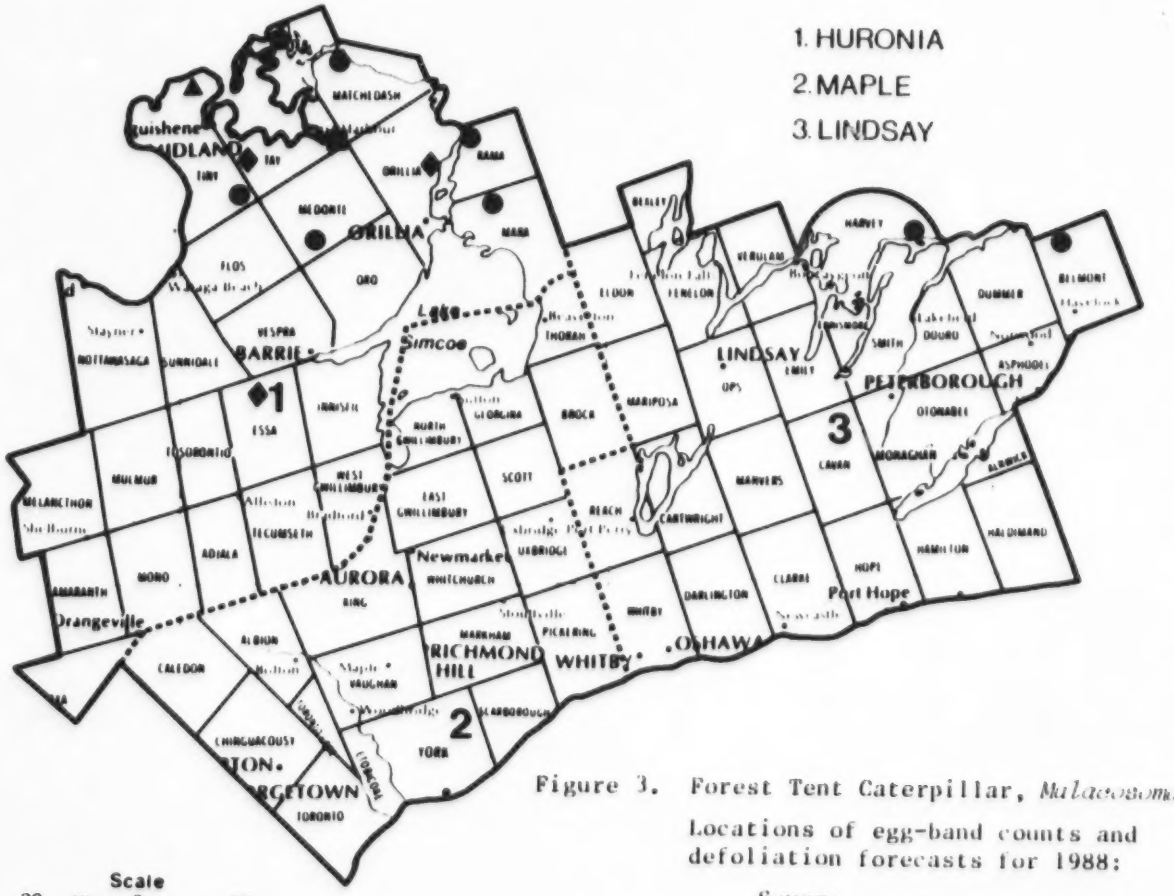


Figure 3. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Locations of egg-band counts and defoliation forecasts for 1988:

Severe . . . . . ●

Moderate . . . . . ■

Light . . . . . ▲

Nil . . . . . ◆

Huronia District. Various red pine plantations 1-2 m in height had defoliation levels of 30-40% in Clarke and Haldimand townships, Lindsay District. Lower population levels were found at Balsam Lake Provincial Park, in Bexley Township, and in Harvey Township, where defoliation by the sawfly was compounded by the presence of the pine false webworm. The Lecontvirus was applied by OMNR in a 10-ha red pine plantation in Eldon Township, Lindsay District.

Bruce Spanworm, *Operophtera bruceata* (Hlst.)

The only occurrence of this early-summer defoliator of hardwoods was in Lindsay District. In the northern part of the district, trace defoliation levels (<5%) were confined to understory sugar maple in Verulam and Harvey townships. The population that was present last year in Oro Township, Huronia District, collapsed and no damage was found in 1987.

Table 4. A summary of forest tent caterpillar egg-band counts done in the Huronia and Lindsay districts in 1987, with infestation forecasts for 1988.

Location (Twp)	Host	Avg DBH of trees (cm)	Avg no. of egg bands per tree	Infestation forecast for 1988[a]
Huronia District				
Baxter-Six Mile Lake Park	tA	15	23	S
Baxter-Six Mile Lake Park	rO	17	33	S
Essa-Tiffen Con. Area	sM	16	0	N
Mara	tA	14	31	S
Matchedash	tA	16	31	S
Medonte-Copeland Forest	sM	14	14	S
Orillia	sM	17	0	N
Rama	tA	14	12	S
Tay-Wye Marsh Provincial Wildlife Areas	sM	16	0	N
Tay	tA	15	3	M
Tiny-Awenda Park	lA	18	5	L
Tiny	sM	15	45	S
Lindsay District				
Belmont	sM	11	37	S
Harvey	sM	14	32	S

[a] N = nil, L = light, M = moderate, S = severe

White Pine Weevil, *Pissodes strobi* (Peck)

Population levels increased slightly in parts of the region. Leader damage levels of 3% and 2% were observed in 4-ha and 11-ha plantations, respectively, of eastern white pine in Flos Township, Huronia District. Approximately 5% of leaders were killed in a 5-ha plantation of 1-m to 2-m eastern white pine in Rama Township, Huronia District. Population levels were lower in a small patch of 2-m trees in Whitchurch Township, Maple District, and in Vespra Township, Huronia District.

Minor Insects

Oak Skeletonizer, *Bucculatrix ainsliella* Murt.

As in 1986, damage levels decreased. The incidence level increased in Niagara District, but defoliation levels were generally less than 5%. The two exceptions to this were in an 8-ha red oak woodlot in Humberstone Township and in a 0.5-ha mixed red and white oak (*Quercus alba* L.) woodlot in Bertie Township, where 10% of the trees averaged 10% defoliation. Levels of foliar damage in the 10-20% range were observed on red oak at Thornton Bales Conservation Area, Maple District; in Sunnidale Township, Huronia District; and at Bronte Creek Provincial Park and in a woodlot in Trafalgar Township, Cambridge District. Second-generation insect populations were also present at numerous points in the aforementioned districts; however, detailed observations were not made.

Table 5. Other forest insects.

Insect	Host(s)	Remarks
Anisota virginiensis virginiensis (Dru.) Pinkstriped oakworm	rO	<2% defoliation on 3-m regeneration in Hope Twp, Lindsay District
Aphrophora cribrata (Wlk.) Pine spittlebug	wP	30% of branch tips attacked in a 3-ha plantation at Balsam Lake Provincial Park, Lindsay District
Archips cerasivorana (Fitch) Uglynest caterpillar	cherry	a few tents on shrubs at CFB Borden, Huronia District

(cont'd)

Table 5. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Arge pectoralis (Leach) Birch sawfly	wB	a single colony on one 5-m tree, causing 30% defoliation, in Alnwick Twp, Lindsay District
Conophthorus coniperda (Sz.) White pine cone beetle	wP	second-year cones damaged at Angus Seed Plant, Huronia District
Cynipidae (sp. not identified) Gall wasps	pO	35% crown mortality on several mature ornamentals in Niagara Twp, Niagara District
Datana integerrima G. & R. Walnut caterpillar	bWa	In nine townships in Niagara District, incidence was 16%, with an average defoliation level of 5%.
Datana ministra (Drury) Yellownecked caterpillar	E	a single colony on a 4-m tree in Alnwick Twp, Lindsay District
Diprion similis (Htg.) Introduced pine sawfly	wP	Populations decreased; 1% defoliation was noted on a few 2-m trees in Rama Twp, Huronia District.
Epinotia aceriella (Clem.) Maple trumpet skeletonizer	sM	endemic populations at numerous points throughout the region
Exoteleia dodecella (L.) Pine bud moth	jP	caused noticeable browning in a small patch of trees at CFB Borden, Huronia District
Exoteleia pinifoliella (Cham.) Pine needleminer	jP	20% level of defoliation on a few trees in West Gwillimbury Twp, Huronia District

(cont'd)

Table 5. Other forest insects (cont'd).

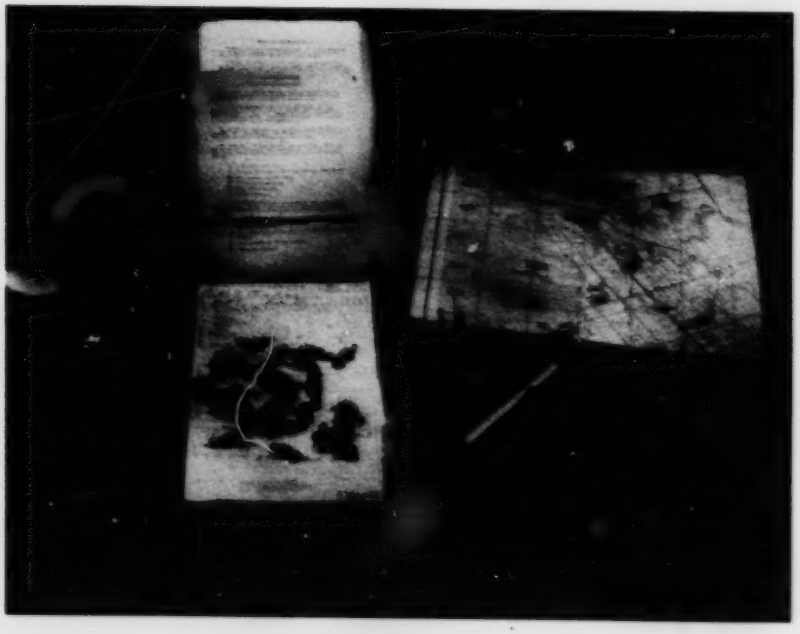
Insect	Host(s)	Remarks
Fenusa ulmi Sund. Elm leafminer	E	50 to 80% foliar damage on single trees in Whitchurch Twp, Maple District, and in the Ancaster area, Cambridge District
Gonioctena americana (Schaef.) American aspen beetle	bPo	5% leaf surface damaged at numerous locations along the eastern side of Lindsay District
Hylobius radicis Buch. Pine root collar weevil	ScP	individual trees killed in Christmas tree plantations in Huronia District
Lepidosaphes ulmi (L.) Oystershell scale	Be	Large numbers of insects caused branch tip mortality scattered across Huronia District.
Neodiprion sertifer (Geoff.) European pine sawfly	rP	2% of trees affected and 3% defoliation in a 6-ha plantation in Mono Twp, Huronia District
Oligonychus ununguis (Jac.) Spruce spider mite	wS eC	common pest on ornamentals at many sites in Maple and Cambridge districts
Oreana unicolorella Hlst. Micro moth	E	a few roadside saplings with 30% defoliation in Haldimand Twp, Lindsay District
Phyllonorycter lucetiella (Clem.) Basswood squareblotch miner	Ba	20% defoliation on understory trees in a 10-ha stand in Haldimand Twp, Lindsay District
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS coiS	50 to 70% defoliation on six 6-m ornamentals in Essa Twp and ten 4-m blue spruce (*Picea pungens* Engelm.) in Tiny Twp, Huronia District

(cont'd)

Table 5. Other forest insects (concl.)

Insect	Host(s)	Remarks
Podapion gallicola Riley Pine gall weevil	rP	Surveys have detected this insect in virtually every stand in Haldimand Twp, Lindsay District. Small pockets of mortality were found in four plantations and 10% branch mortality was common in many plantations; 40 galls per tree were often found. Much lower populations were present at other sites in the region.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	Mo	Defoliation levels ranging from 50 to 90% were found on ornamentals at Darlington and Serpent Mounds provincial parks, Lindsay District, and at one site in Whitchurch Twp, Maple District. Sporadic occurrences of damaging populations were common elsewhere in the region.
Psilocorsis reflexella Clem. Flat leaftier	rO, tA	20-80% damage levels in four very small pockets in Lindsay District
Rhyacionia buoliana (D. & S.) European pine shoot moth	rP	damaged terminal growth at various sites in Cambridge District
Rhynchaenus rufipes (LeC.) Willow flea weevil	W	60-100% foliar damage to scattered ornamentals in McRae Point Provincial Park, Huronia District
Scolioneura betuleti (Klug.) Birch edgeminer	birch	low population levels on roadside ornamentals at two sites in King Twp, Maple District
Tetralopha asperatella (Clem.) Maple webworm	sM	10 to 15% defoliation at one location in Belmont Twp, Lindsay District

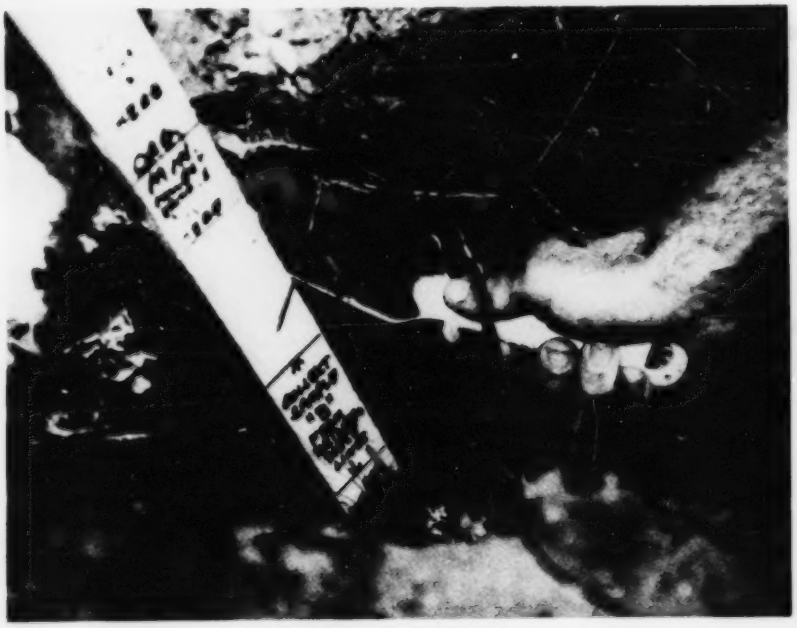
Heavy defoliation of red oak (*Quercus rubra* L.)
by forest tent caterpillar (*Malacosoma disstria* Hbn.)



Egg-band counting to forecast tent caterpillar
infestations

Ontario
Ministry of Natural Resources
YORK REGIONAL FOREST STAND CONVERSION PROJECT
1985 CLEARCUT of Scots and Jack Pine infected by Pine Blight (Diplodia pinea)
1986 SITE PREPARATION of cutover area
1987 REPLANT cutover area to Red and White Pine

An effort to control tip blight (*Sphaeropsis sapinea* [Fr.] Dyko & B. Sutton (*Diplodia pinea*) in Maple District



Taking a B-horizon soil sample from an ARNEWS plot

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

This root rot is one of the most common fungi present in dead and dying trees in the region. Armillaria is unique in that it can cause xylem decay and the death of cambium in living trees. This enables the fungus to develop as decay on dead or weakened trees and to cause the death of both weakened and healthy trees. Sporadic occurrences of this root rot on red pine at levels below 1% were noted on 0.5-m trees in a frost pocket in the North Tract and in an 8-ha stand of 20-m trees in the Headquarters Tract, both in Whitchurch Township, Maple District. Mortality associated with this disease was found in young 5-ha and 11-ha red pine plantations, respectively, in Vespra and Flos townships, Huronia District. In Cambridge District, infections were observed on young eastern white pine in Erin Township and on a few sugar maple in a hardwood woodlot in West Garafraxa Township. Young eastern white cedar windbreak trees infected by *A. mellea* continue to die at the Midhurst Forest Station in Huronia District.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Since 1977, annual efforts to detect the presence of either the European race or the North American race of this fungus have been made across southern Ontario. In the Central Region, 30 sites in 18 townships (Fig. 4) were checked for foliar browning, branch mortality and other symptoms of the canker. An aerial reconnaissance was carried out in the spring to detect these symptoms; this was followed by ground surveys of plantations, which varied in height from 2 to 23 m, throughout the remainder of the sampling season. There was no sign of the disease in the Central Region.

Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

Various levels of damage have been reported in the region since 1977. The fungus that causes this tip blight infects new shoots of pines in Ontario, most notably Scots, red and Austrian pine (*Pinus nigra* Arnold). New shoots are killed and repeated attacks can cause branch mortality. Trees that suffer continuing infections become deformed and may ultimately die. This has been the case over the years with many older Scots pine plantations in Maple and Cambridge districts.

Increased occurrence of this disease was observed in various parts of the region. Heavy damage was present again in scattered Scots pine plantations in the Whitchurch-Stouffville area (see photo page) of Maple District and in Puslinch and Beverly townships, Cambridge

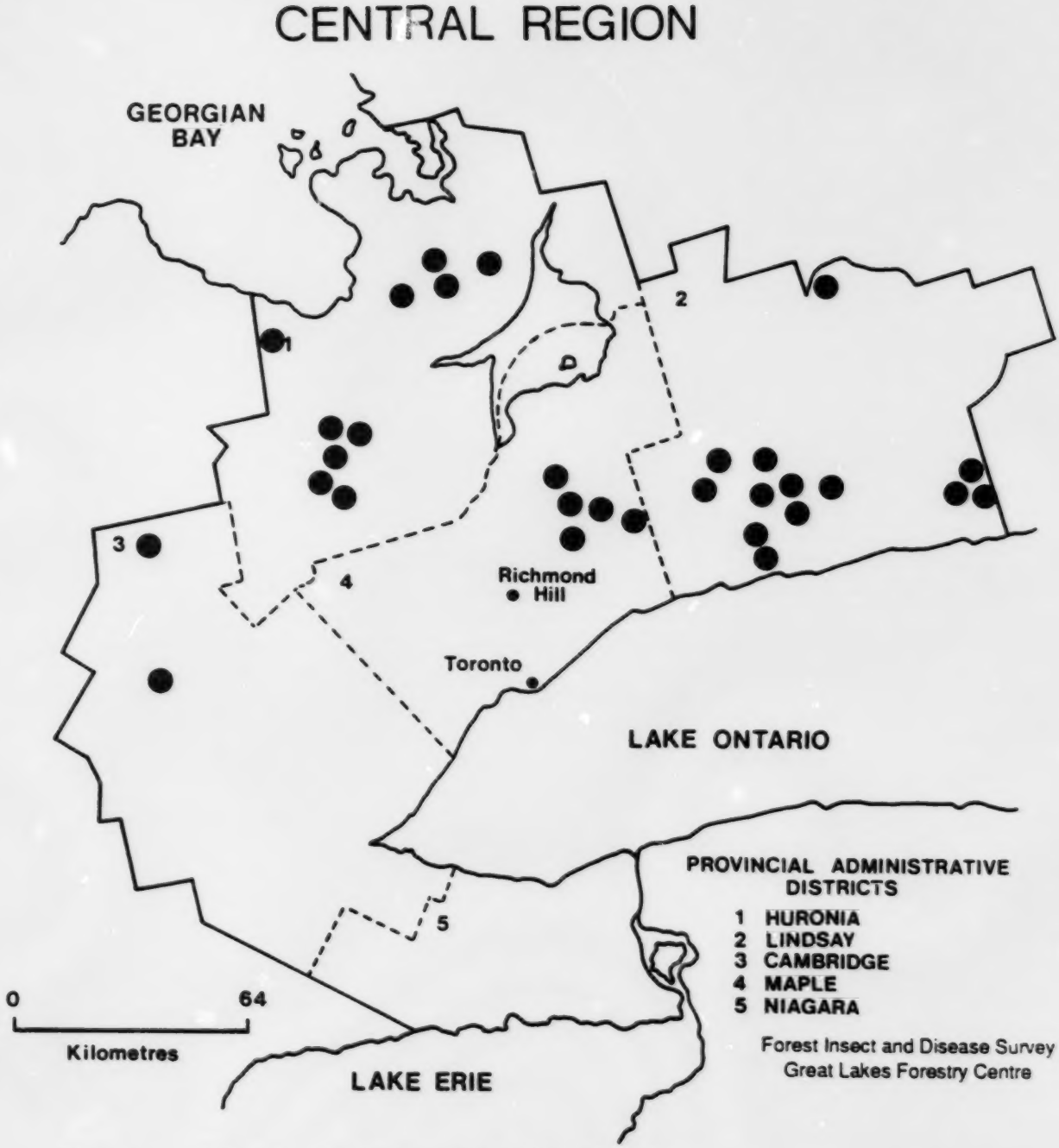


Figure 4. Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Locations at which red pine plantations were surveyed in 1987 . . . . . ●

District. Lower inrection levels were found much more frequently in parts of Huronia District; individuals and small groups, mainly of Scots pine, were affected. The most noteworthy infections were at the Midhurst Forest Station, where older red and Scots pine around the nursery were infected and red pine in adjacent nursery compartments were damaged. Several Austrian pine along Hwy 46 in Eldon Township, Lindsay District experienced 40% branch tip mortality. Many Scots pine Christmas trees had approximately 10% branch mortality in a 3-ha plantation in Tiny Township, Huronia District. Dead shoots and branches were common at many other points throughout the region.

Minor Diseases

Septoria Leaf Spot, *Mycosphaerella populicola* G.E. Thompson

Incidence of this disease fell below the very high infection levels recorded in 1986. Heavy defoliation (near 75%) was observed in small pockets of balsam poplar (*Populus balsamifera* L.) in Haldimand and Belmont townships, Lindsay District. Scattered pockets of trees experienced 30-50% defoliation at many points in the Huronia District as well as at other sites in Lindsay District.

Table 6. Other forest diseases.

Organism	Host(s)	Remarks
Apiognomonia errabunaa (Roberge) Höhnel Anthracnose	Oak	low levels of damage at one location in Belmont Twp, Lindsay District
Apiognomonia quercina (Kleb.) Höhnel Anthracnose	rO	20% foliar infeccion levels on scattered trees in the Wasaga Beach area, Huronia District
Asteroma caryae (Peck) B. Sutton Leaf spot of hickory	sHi	A 2-ha woodlot experienced 10% foliar damage on 65% of the trees in Louth Twp, and 20% foliar damage occurred on most trees in a 1.5-ha woodlot in Seneca Twp, Niagara District.
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	Elm	Four 10-m roadside trees experienced various levels of crown mortality in Vespra Twp, Huronia District.

(cont'd)

Table 6. Other forest diseases (concl.).

Organism	Host(s)	Remarks
Cronartium ribicola J.C. Fischer White pine blister rust	wP	2% tree mortality in a small plantation in Erin Twp, Cambridge District, and similar levels with some branch mortality on 2-m trees in Flos Twp, Huronia District
Endocronartium sp. Gall rust	scP	killed branches on scattered Christmas trees in Tiny Twp, Huronia District
Guignardia aesculi (Peck) Stewart Leaf blotch	Horse-chestnut	30% foliar damage common at points in Niagara District, and lower levels in Cambridge District
Heterobasidion annosum (Fr.) Bref. Fomes root rot	rP	About 5% of the 14-m trees were dead or dying in an 8-ha plantation in Cartwright Twp, Lindsay District.
Marssonina populi (Lib.) Magnus Marssonina leaf spot	tA	infection levels of 40% on individual trees scattered across the Huronia District
Verticillium sp. Verticillium wilt	maple	samples from ornamentals in Tay and Mulmur twps, Huronia District

DIEBACKS AND DECLINES

Maple Dieback

As part of the Forest Insect and Disease Survey's work on dieback and decline monitoring, 10 sugar maple dieback plots were established in the region this year (Fig. 5). Mature and semi-mature stands with a high component of sugar maple were selected and a 25-tree plot was laid out. Some basic physical data on the trees were collected (Table 7). There was no sign of dieback in any of the trees examined. Some trees had other types of damage, such as old borer wounds, cracks and mechanical damage; however, none of this damage seemed to be affecting tree vigor. Additional plots will be established in 1988 and the existing ones will be checked again. The only occurrence of maple dieback in the region was found on older roadside trees along major highways.

Oak Decline

The red oak trees that make up the five decline plots in the Huronia, Maple and Lindsay districts (Fig. 5) were examined once again. Mortality levels increased by one or two trees in all plots except the one at Farlain Lake, where no additional mortality occurred (Table 8). The only plot in which overall crown death increased was in Uxbridge Township, where the number of trees in the 21-40% damage class doubled since 1986. Oak leaf shredder populations in the plots were similar to those in 1986, although increased levels were reported at the Uxbridge and Farlain Lake plots. Trace levels (2-3%) of defoliation by gypsy moth and forest tent caterpillar were observed on the plot trees in Clarke Township. Very low numbers of gypsy moth larvae were found on some of the tree trunks at the Uxbridge plot.

CENTRAL REGION

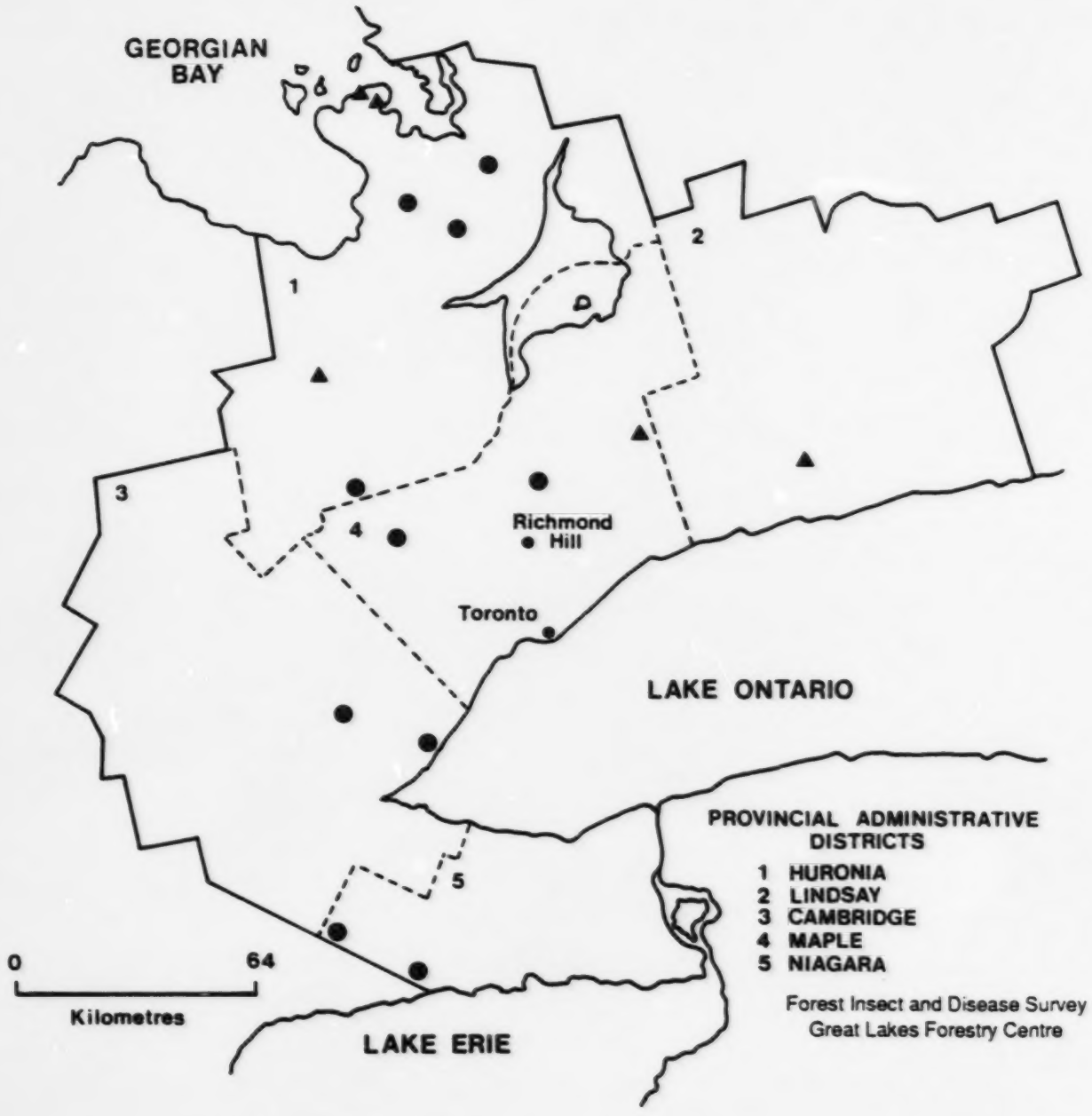


Figure 5. Dieback and Decline Plots - 1987

Sugar Maple Plots . . . . . ●

Red Oak Plots . . . . . ▲

Table 7. Summary of sugar maple dieback plots established at 10 locations in the Central Region in 1987.

Location (Twp)	Avg DBH	Avg ht	Percentage of dead crown					No. of dead trees
			0-5	6-20	21-40	41-50	61+	
			No. of trees					
Cambridge District								
Nassagaweya	31.5	27	0	0	0	0	0	0
Trafalgar	43.6	35	0	0	0	0	0	0
Huronia District								
Adjala	33.0	27	0	0	0	0	0	0
Flos	33.4	27	0	0	0	0	0	0
Medonte	38.0	30	0	0	0	0	0	0
Oro	26.5	23	0	0	0	0	0	0
Maple District								
Albion	39.7	29	0	0	0	0	0	0
Whitchurch	35.5	21	0	0	0	0	0	0
Niagara District								
Oneida	40.4	27	0	0	0	0	0	0
South Cayuga	21.2	21	0	0	0	0	0	0

Table 8. Summary of oak decline at five locations in the Central Region from 1977 to 1987.

Location	Avg DBH[a]	Avg ht[a]	Year	Percentage of dead crown 0-20	21-40	41-60	61+	No. of dead trees	Oak leaf shredder activity[b]
				- - - No. of trees - - -					
Huronia District									
Tiny Twp	25.9	21.9	1977	54	7	27	12	0	T[c]
Awenda Provincial Park			1978	48	5	22	6	4	T[c]
			1979	58	9	3	4	8	T[c]
			1980	61	8	4	4	8	T
			1981	57	14	2	3	8	T
			1982	63	9	1	3	8	T
			1983	61	11	2	2	9	T
			1984	62	9	4	1	9	T
			1985	66	9	0	1	9	T
			1986	72	2	1	0	10	T
			1987	70	4	0	0	11	T
Tiny Twp									
Farlain Lake	26.0	22.0		1977-1979 - not sampled -					S
			1980	0	4	45	25	26	S
			1981	0	11	35	25	29	L
			1982	7	30	22	9	32	L
			1983	11	32	19	5	33	L
			1984	31	25	6	5	33	T
			1985	49	12	3	1	34	T
			1986	53	7	1	0	38	T
			1987	58	2	1	0	38	L
Mulmur Twp									
Dufferin Forest	28.2	21.0	1977	64	15	20	1	0	S
			1978	64	15	19	1	1	L[c]
			1979	68	15	15	1	1	T
			1980	57	28	13	1	1	L
			1981	43	34	16	2	1	M
			1982	44	39	10	1	2	M[c]
			1983	48	33	11	2	2	L[c]
			1984	53	33	6	0	4	T
			1985	71	19	2	0	4	T
			1986	90	2	0	0	4	T
			1987	86	3	0	1	6	T

(cont'd)

Table 8. Summary of oak decline at five locations in the Central Region from 1977 to 1987 (concl.).

Location	Avg DBH[a]	Avg ht[a]	Year	Percentage of dead crown				No. of dead trees	Oak leaf shredder activity[b]
				0-20	21-40	41-60	61+		
				No. of trees					
Maple District									
Uxbridge Twp	26.1	21.2	1977	42	9	31	18	0	M
Durham Forest			1978	42	9	31	11	7	L
			1979	40	13	26	6	15	M
			1980	38	14	25	7	16	L[c]
			1981	27	22	26	6	19	L
			1982	29	33	12	6	20	M
			1983	33	31	9	4	23	M
			1984	40	27	6	3	24	L
			1985	53	17	4	1	25	L
			1986	62	12	1	0	25	L
			1987	50	24	0	0	26	M
Lindsay District									
Clarke Twp	22.9	20.6	1977	38	11	32	19	0	L
Ganaraska Forest			1978	4	36	39	13	8	L
			1979	3	32	41	16	8	L
			1980	2	26	47	16[d]	9[d]	L
			1981	2	26	47	16[d]	9[d]	T
			1982	1	32	44	14[d]	9[d]	N
			1983	5	57	26	3	9	N
			1984	76	10	2	2	10	N
			1985	66	19	2	2	11	N
			1986	66	16	5	2	11	N
			1987	79	6	2	1	12	N

[a] on the basis of 1977 measurements

[b] N = nil, T = trace, L = light, M = moderate, S = severe

[c] aerially sprayed to control oak leaf shredder

[d] data correction

ABIOTIC DAMAGE

Drought

Scattered pockets of sugar maple and white birch growing on shallow, rocky sites along the northern edge of the region started to turn yellow about mid-August. Some reductions in precipitation did occur at various times during the late winter and spring and temperatures during the spring and summer months were warmer than normal (see Table 11 - Climatic Data). The areas most affected were those along the edge of the Canadian Shield in parts of all the northern townships in Lindsay District and in Baxter, Matchedash, and Rama townships, Huronia District (Fig. 6).

Salt

Damage to roadside conifers by salt, which was used on major roads in the region, was observed at various points. In Lindsay District, 2-3% tree mortality of red and Scots pine was seen along the Hwy 115 corridor, east of the junction with Hwy 35. Damaged foliage was also observed on trees of these species at other points along these highways and along Highway 401. In two red pine plantations in Albion and Caledon townships, 75-100% damage was observed on the first two or three rows of 2-m trees. Patches of 2-m red and eastern white pines with foliar damage levels that ranged from 50 to 80% were observed along Hwy 24 in Mulmur Township, Huronia District. Various damage levels were reported for individual trees and small groups at other points in the region.

Table 9. Other abiotic damage.

Type of damage	Host(s)	Remarks
Leaf scorch	sM, nM	Damage to 10% of the leaf surface of 75% of the crown was common on mature roadside trees and ornamentals in Niagara District.
Frost	wS	10% mortality to 300,000 bareroot seedlings planted in the Lindsay District in 1987
Winter drying	eC, rP	trace damage levels (1-4%) at a few locations in Niagara and Huronia districts

HURONIA, MAPLE and LINDSAY DISTRICTS

Figure 6. Drought Damage

Areas within which damage occurred in 1987 . . . . . or ●

Forest Insect and Disease Survey
Great Lakes Forestry Centre

SPECIAL SURVEYS

White Spruce Plantations

This year represents the third time a formal survey has been carried out in white spruce plantations throughout the Central Region. The format has remained the same: plantations in the three height groups (0.5 m to 2.0 m, 2.1 m to 6.0 m and >6.0 m) are examined. The major insects, diseases and abiotic problems found in 1987 are summarized in Table 10. Armillaria root rot was the only disease found and it was present at only one site in Medonte Township, Huronia District. In addition to the insects listed in the table, the eastern spruce gall adelgid (*Adelges abietis* [L.]) was found, but at insignificant levels, in 11% and 3% of the trees in East Flamborough Township, Cambridge District, and Bexley Township, Lindsay District, respectively. A Zeiraphera shootworm (*Zeiraphera* sp.) was present on 87% and 17% of the trees examined in Melancthon Township, Huronia District, and East Flamborough Township, respectively; however, populations were so small on affected trees that no noteworthy defoliation was observed. Ants (*Formica* sp.) were responsible for the death of one tree of the 150 examined at the plantation in King Township, Maple District.

The most significant difference between the 1987 survey and those done in 1981 and 1984 was that spruce budworm and spruce coneworm (*Dioryctria reniculelloides* Mut. & Mun.) were no longer present in the plantations. Levels of other major pests were also generally lower this year.

White Spruce Cone and Seed Pests

In 1987, a sample of white spruce cones was submitted for laboratory examination to assess the impact of pests on seed cone production. In mid-July, 100 green cones were obtained from the Glencairn Seed Orchard in Tosorontio Township, Huronia District. Approximately half of the cones were found to be damaged, and as a result there was an average of 59% loss of seed. The three most important insects that affected the cones, and the respective levels of damage they caused, were: the spruce cone maggot (*Lasiomma anthracinum* [Czerny]), at 33%; the spruce seed moth (*Cydia strobilella* [L.]), at 79%; and the fir coneworm (*Dioryctria abietivorella* [Grt.]), at 3%. There were no disease organisms on the sampled cones.

Table 10. Summary of the results of the white spruce plantation pest survey carried out in the Central Region in 1987.

Location (Twp)	Avg ht (m)	Plant-tion area (ha)	Trees/ha (esti-mated)	Yellowheaded spruce sawfly		White pine weevil	Armillaria root rot	Frost	
				trees affected (%)	defoli-ation (%)	leaders affected (%)	trees affected (%)	trees affected (%)	defoli-ation (%)
Cambridge District									
East Flamborough	2.9	1.5	2300	0	0	0	0	0	0
Huronia District									
Medonte	15.0	11.0	1800	0	0	0	1	0	0
Melancthon	10.7	5.0	1000	0	0	0	0	0	0
Lindsay District									
Bexley	5.0	6.0	1700	4	2	5	0	79	2
Haldimand	19.0	0.5	2000	0	0	0	0	0	0
Maple District									
Caledon	0.6	8.0	2500	0	0	0	0	0	0
King	2.1	6.0	2400	0	0	0	0	0	0

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

As part of the monitoring of this worm-like pest found in dying conifers, some special sampling was carried out in 1987. A collection of whitespotted sawyer beetle (*Monochamus scutellatus* [Say]) adults was submitted from a red pine plantation in Tosorontio Township, Huronia District, since sawyer beetles are known to be carriers of nematodes; however, in this case, no nematodes were found. In Huronia District, wood samples were taken from a wind-damaged red pine in Tiny Township and a dead balsam fir in Medonte Township. Pinewood nematodes were not found in either sample. Some further work was carried out in a pocket of dead and dying red pine in the Orr Lake Tract in Flos Township, Huronia District, in which pinewood nematode had been found in 1985. In an effort to determine if the nematodes are contributing to further mortality, all dead trees and those that displayed symptoms of nematode activity were marked. This plot will be examined again in 1988.

Acid Rain National Early Warning System (ARNEWS)

As part of the FIDS responsibility for the detection of forest damage, two plots were established in the Central Region for the purpose of monitoring acid rain damage. In 1984 an ARNEWS study plot was established in a semimature sugar maple stand in the South Barr Tract of Simcoe County Forest, Huronia District. The following year, an eastern white pine plot was set up in a plantation in the Ospringe Tract on Grand River Conservation Authority property in Cambridge District. This year the only pests found were in the eastern white pine plot where, as in the previous year, white pine blister rust (*Cronartium ribicola* J.C. Fischer) killed one tree and the pine bark adelgid (*Pineus strobi* [Htg.]) was found at trace levels on four trees. Symptoms attributable to acid rain damage were not found in either plot. In addition to the monitoring of aboveground changes in vegetation, soil samples were taken. Five sampling stations were established just outside the plot boundaries. Within a 5-m radius of each station five small holes were dug at random locations. Samples of material from the duff layer, the A-horizon and the B-horizon were taken (see photo page). These samples were packaged and sent to the GLFC laboratory, where analysis of various chemical parameters will be carried out.

Beech Scale, *Cryptococcus fagisuga* Lindinger, and Beech Bark Disease, *Nectria coccinea* var. *faginata* Lohm., Wats. & Ay.

A special effort was made this year to gather more information about the occurrence of the beech scale insect and, consequently, about the distribution of the beech bark disease as well. The prolonged presence of beech scale on the trunks of beech (*Fagus grandifolia* Ehrh.) predisposes the tree to attack by the beech bark disease. Although beech bark disease has not yet been found in Ontario, scale insects have

been found. In 1987, scale insects were observed at trace levels at four locations in Maple District, in each of Whitchurch, King, Albion, and Caledon townships. Scale insects were found in relatively large numbers on a few large trees at Bronte Creek Provincial Park and at trace levels at one site in West Garafraxa Township in Cambridge District. Some additional trees were checked in Huronia and Niagara districts, but no insects were found.

Climatic Data

Climatic extremes commonly have adverse effects on the forest. Such things as high winds (which result in blowdown), unseasonable cold temperatures (which can cause foliar damage), and marked reductions in normal rainfall (which cause drought damage) are three examples of this. Table 11 lists mean monthly temperatures and total precipitation for 1987, as recorded by the Atmospheric Environment Service. The deviation from the 30-year average values is also reported. See the "Abiotic Damage" section of this report for information on weather-related damage.

Table 11. A summary of temperature and precipitation for 1987 at two locations in the Central Region

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
Peterborough Airport	January	-9.3	-7.3	+2.0	44.1	43.3	-0.8
	February	-8.5	-8.6	-0.1	48.9	17.9	-31.0
	March	-2.5	0.5	+3.0	62.9	76.5	+13.6
	April	6.0	9.0	+3.0	71.8	56.0	-15.8
	May	12.1	13.4	+1.3	57.1	41.6	-15.5
	June	16.8	17.9	+1.1	60.4	73.1	+12.7
	July	19.2	21.3	+2.1	77.9	44.4	-33.5
	August	18.1	17.9	-0.2	74.2	84.1	+9.9
	September	14.0	13.9	-0.1	72.9	85.2	+12.3
	October	7.9	5.5	-2.4	59.9	64.0	+4.1
	November	2.1	1.6	-0.5	69.4	96.6	+27.2
	December	-6.0	-2.0	+4.0	74.3	59.9	-14.4
Lester B. Pearson International Airport	January	-6.7	-4.6	+2.1	50.4	56.6	+6.2
	February	-6.1	-5.8	+0.3	46.0	14.8	+31.2
	March	-1.0	1.8	+2.8	61.1	44.2	-16.9
	April	6.2	8.8	+2.6	70.0	49.8	-20.2
	May	12.3	14.7	+2.4	66.0	29.6	-36.4
	June	17.7	19.6	+1.9	67.1	68.3	+1.2
	July	20.6	22.5	+1.9	71.4	108.1	+36.7
	August	19.7	19.6	-0.1	76.8	52.3	-24.5
	September	15.5	15.5	0.0	63.5	108.0	+44.5
	October	9.3	7.0	-2.3	61.8	48.1	-13.7
	November	3.3	3.4	+0.1	62.7	83.4	+20.7
	December	-3.5	-0.3	+3.2	64.7	47.7	-17.0